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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|--------------------------|---------------------|------------------|
| 09/929,894 | 08/14/2001 | Henry Esmond Butterworth | GB920000053US1 | 9289 |
| 7590 | 07/08/2004 | | EXAMINER | |
| Abdy Raissinia IBM Corp. IP Law, Department L2PA/014-2 5600 Cottle Road San Jose, CA 95193 | | | LE, MIRANDA | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2177 | 8 |
| DATE MAILED: 07/08/2004 | | | | |

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | |
|------------------------------|------------------------|------------------------------|
| Office Action Summary | Application No. | Applicant(s) |
| | 09/929,894 | BUTTERWORTH, HENRY ESMOND |
| Examiner | Art Unit | |
| Miranda Le | 2177 | |

~ The MAILING DATE of this communication appears on the cover sheet with the correspondence address ~

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 14 August 2001.
 2a) This action is FINAL. 2b) This action is non-final.
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-27 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
 5) Claim(s) _____ is/are allowed.
 6) Claim(s) 1-27 is/are rejected.
 7) Claim(s) _____ is/are objected to.
 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ . |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>5</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| | 6) <input type="checkbox"/> Other: _____ . |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 1-18, 21-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Burkes et al. (US Patent No. 5,604,902).

As to claims 1, 14, 27, Burkes teaches a method for performing free space collection (i.e. garbage collection) in an information storage system having storage units in which information segments are located, the method comprising the steps of: determining a fitness value (i.e. a weight value, col. 8, lines 30-35) for at least some of the segments by determining the product of the amount of free space (i.e. a number of holes, col. 8, lines 30-35) in the segment and the expected time the free space will last (i.e. the ages of the blocks in the area, col. 8, lines 30-61, Fig. 4). It is noted that although Burkes does not specifically teach the step of computing the product of the amount of free space in the segment and the expected time the free space will last, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the

Burkes system to include the step of computing the product of the amount of free space in the segment and the expected time the free space will last to determine a fitness value.

By doing this, the data storage system can efficiently maintain the table and easily identify a selection criterion for selecting candidates for defragmentation (freeing) and uses the criterion to select candidates from a subset of the population of areas having a sufficient number of candidates for deframentation, thereby providing better overall garbage collection efficiency and performance, as taught by Burkes at col. 8, lines 49-58.

Burkes teaches “choosing segments for free space collection with the maximum fitness values” at col. 8, lines 38-59.

As to claims 2, 15, Burkes teaches “the expected time the free space in a given segment will last is estimated by the rate of use of still-in-use data in the segment” at col. 7, lines 13-26.

As to claims 3, 16, Burkes teaches a fitness value (i.e. a weight value, col. 8, lines 30-35) for at least some of the segments, the amount of free space (i.e. a number of holes, col. 8, lines 30-35) in the segment, and the expected time the free space will last (i.e. the ages of the blocks in the area, col. 8, lines 30-35), but Burkes does not particularly teach the fitness value is determined by the equation, wherein segment age is the interval between a current time and a time at which the data in the segment was last written. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the Burkes system to include the claimed equation to determine a fitness value. By doing this, the data storage system can efficiently maintain the table

and easily identify a selection criterion for selecting candidates for defragmentation (freeing) and uses the criterion to select candidates from a subset of the population of areas having a sufficient number of candidates for defragmentation, thereby providing better overall garbage collection efficiency and performance, as taught by Burkes at col. 8, lines 49-58.

As to claims 4, 17, Burkes teaches “the segment age is measured in one of real time, number of write transactions, number of segments written or destage sequence number” at col. 8, lines 16-61.

As per claim 5, Burkes teaches “the segment age is one of an average, maximum or minimum of the ages of the data in the segment” at col. 8, lines 16-36.

As per claim 6, Burkes teaches “the segment age also includes a write interval for the segment” at col. 9, lines 9-52.

As per claim 7, Burkes teaches “a fitness value is determined for one of each of a group of sorted segments” at col. 9, lines 9-52.

As per claim 8, Burkes teaches “the segments are sorted by the amount of used data in each segment, each group of segments having a given range of amount of used data” at col. 8, lines 16-61, col. 10, lines 1-46.

As per claim 9, Burkes teaches “all full segments are sorted into one group and the remaining groups have equal ranges of amounts of used data” at col. 10, lines 1-46.

As to claims 10, 21, Burkes teaches “the segments are listed within each group in a first-in first-out list and the fitness value is determined for the segment at the head of the list” at col. 8, lines 16-61, col. 10, lines 1-46.

As to claims 11, 22, Burkes teaches “the segments are sorted within each group by the time at which the data in the segment was last written or by a destage sequence number and the fitness value is determined for the segment with the greatest age in each group” at col. 9, lines 9-52.

As to claims 12, 23, Burkes teaches “the segments are sorted by a tree data structure” at col. 10, lines 46-59.

As to claims 13, 24, Burkes teaches “the method is used in a log structured information storage system” at col. 8, lines 46-59, col. 3, lines 51-67, col. 10, lines 46-59.

As per claim 18, Burkes teaches “the segments are sorted into groups and the means for determining a fitness value is applied to one segment from each group” at col. 10, lines 1-46, col. 8, lines 16-59.

As per claim 25, Burkes teaches “the storage system is a log structured file system” at col. 8, lines 46-59, col. 3, lines 51-67, col. 10, lines 46-59.

As per claim 26, Burkes teaches “the information storage system is an external storage system and is a log structured array” at col. 8, lines 46-59, col. 3, lines 51-67, col. 10, lines 46-59.

3. Claims 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Burkes et al. (US Patent No. 5,604,902), in view of Moore et al. (US Patent No. 6,282,605 B1).

As per claim 19, Burkes does not explicitly teach “the segments are sorted by the amount of used data in each segment, each group of segments having a given range of amount of used data”. However, Moore teaches this limitation at col. 2, line 37 to col. 3, line 45.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teachings of Burkes with the teachings of Moore to include “the segments are sorted by the amount of used data in each segment, each group of segments having a given range of amount of used data” in order to provide a system for ascertaining the physical locations of files in random access memories, in which data is written in blocks of various sizes and in which erasure of data to recover memory space for rewriting of data is constrained to relatively large zones of contiguous locations.

As per claim 20, Moore teaches “all full segments are sorted into one group and the remaining groups have equal ranges of amounts of used data” at col. 2, line 37 to col. 3, line 45.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Miranda Le whose telephone number is (703) 305-3203. The examiner can normally be reached on Monday through Friday from 8:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John E. Breene, can be reached on (703) 305-9790. The fax number to this Art Unit is (703) 872-9306. The TC 2100's Customer Service number is (703) 306-5631.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 305-3900.



Miranda Le
June 25, 2004



GRETA REGINON
PRIMARY EXAMINER